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(54) Pipe spray coating apparatus

(57) Apparatus for spray coating a non-rotating pipe comprises a support frame 3 carrying a rotary frame 5, drive 35 carried by the support frame 3 for rotating the rotary frame 5 and a spray head 7 mounted on the rotary frame 5 for applying a coating to the pipe. The support frame 3 includes a port 15 for receiving a supply of coating material and the rotary frame 5 includes a duct 25 communicating between the supply port 15 and the spray head 7 such that, as the rotary frame 5 is rotated, a supply of coating material is provided to the spray head 7. The rotary frame 5 is free to rotate through 360° whilst being provided with a continual supply of coating material so that the pipe itself need not rotate. The support frame 3 can be movable axially of the pipe to coat a complete length of pipe. The rotary frame 5 is formed in two halves to enable the apparatus to be mounted on a pipeline.

Fig.1

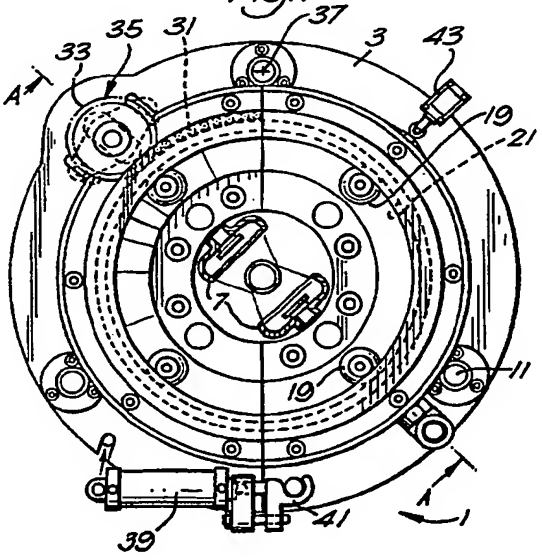
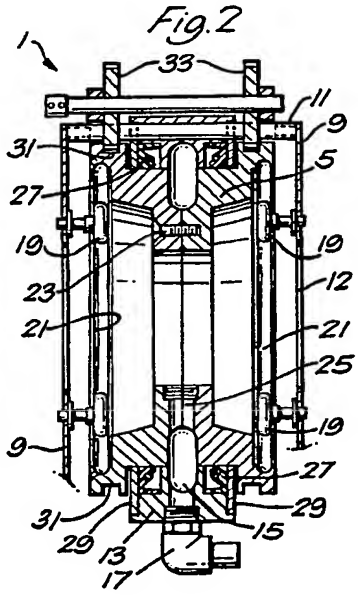


Fig.2



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig. 2

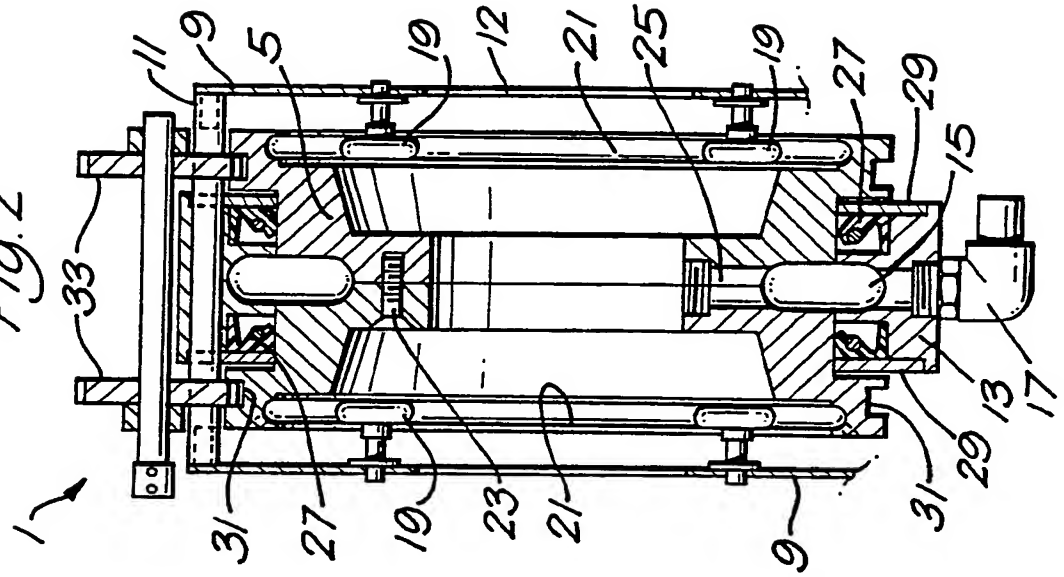
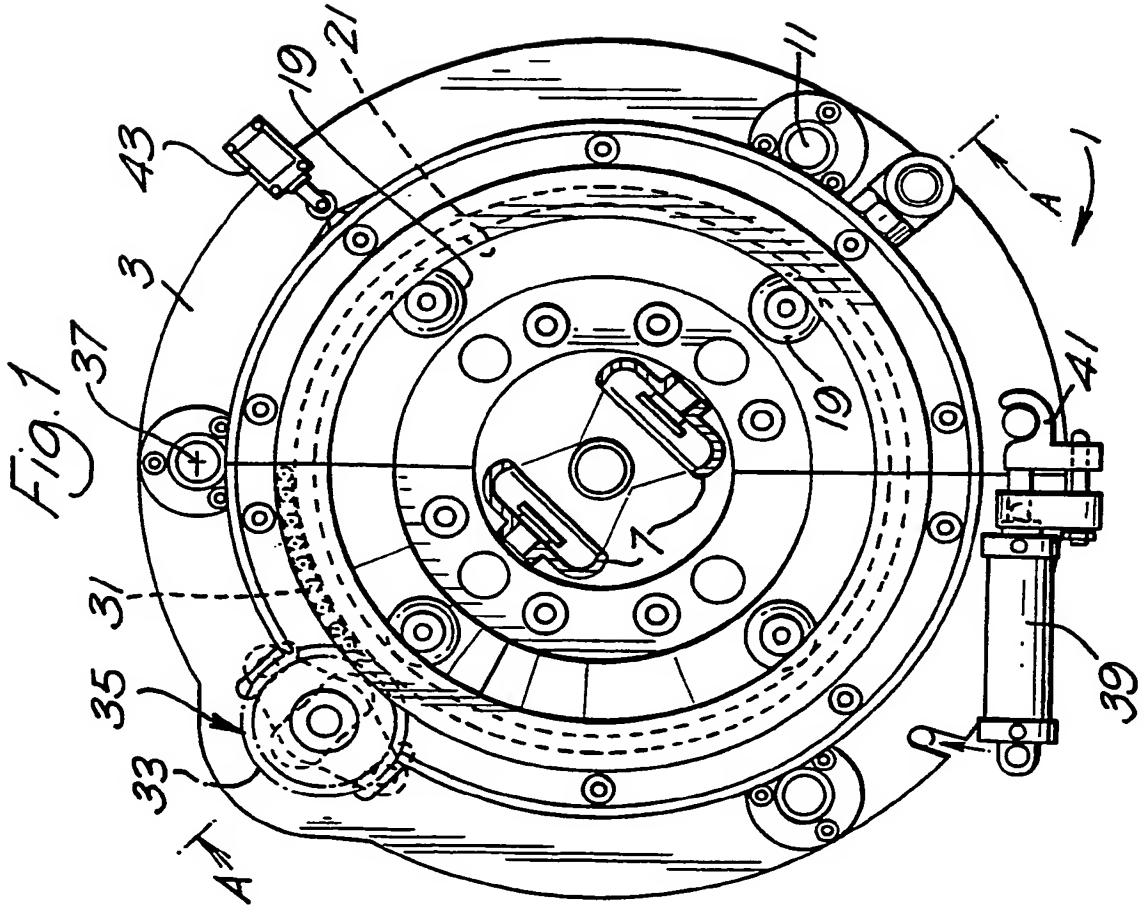


Fig. 1



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A COATING APPARATUS

This invention relates to coating apparatus, and in particular to an apparatus for spraying pipes and the like.

A very high percentage of steel line pipe used throughout the world for the transmission of oil and gas is coated with Fusion Bonded Epoxy (F.B.E.). The material is sintered onto a prepared surface. The main function of the process is to provide an anti-corrosion coating.

The method of coating steel line pipe with F.B.E. is well established, and is primarily geared to the coating of 12 meter lengths of pipe having diameters between 3 inches - 64 inches (7.6 - 163 centimetres). Almost without exception, the way in which the pipes are coated is as follows:

1. blast clean;
2. induction heat;
3. electrostatically apply the powder F.B.E.; and
4. water quench.

During the coating operation described above, the pipes are rotated and moved axially.

Major disadvantages of the known operation described above are as follows:

1. the handling and coating of random pipe lengths;
2. the F.B.E. coating of bends;
3. the coating of fabricated items; and
4. the coating of pipe extending over a ditch (i.e. strung welded pipe).

The present invention aims to overcome the problems associated with the prior art method primarily by eliminating the necessity to rotate pipe during the coating operation. Further, a coating apparatus according to the present invention can be used in a number of ways to overcome the difficulties numbered 1-4 mentioned above.

In view of the foregoing, the present invention provides a coating apparatus comprising a support frame, a rotary frame carried by the support frame, drive means carried by

the support frame for rotating the rotary frame and at least one delivery head mounted on the rotary frame for applying a coating to an article, wherein the support frame includes at least one supply port for receiving a supply of coating material and the rotary frame includes at least one duct communication between the supply port and the delivery head such that, as the rotary frame is rotated by the drive means, a supply of coating material is provided to the delivery head to enable a coating to be applied to an article.

As will be appreciated, the rotary frame is rotated such that the delivery head (or heads) is exposed to the surface to be coated, without any need for the article itself to be rotated. This is a distinct advantage over the apparatus and methods known to date.

If the article is a pipe, the support frame is preferably movable in the axial direction of the pipe so that the complete length of the pipe can be coated.

Preferably the or each delivery head, during use, delivers coating material towards the center of the apparatus. Alternatively, the delivery head or heads may face outwardly from the apparatus to coat an internal surface of a pipeline, for example.

Preferably a chamber is formed by the supply port and a duct for accumulating coating material.

The rotary frame is preferably carried by the support frame via a plurality of rollers acting between the rotary frame and the support frame. The rollers are preferably mounted on a space frame of the support frame and engage a bearing surface formed on the rotary frame.

Preferably the support frame includes two space frames joined by a plurality of location bars. In such a case, rollers are preferably mounted on both space frames and engage two separate bearing surfaces on either side of the rotary frame.

Seals preferably act between the support frame and the rotary frame to prevent unwanted escape of coating material as the rotary frame rotates. The seals may be held in

position in the support frame by means of seal rings attached to the support frame. In any event, the seals, which are preferably annular, are positioned on either side of the or each supply port and contact the rotary frame as it rotates.

The rotary frame is preferably formed in two halves to facilitate assembly of the coating apparatus. The two halves of the rotary frame may be joined by means of screws, bolts or simple studs. Any other suitable joining means may, of course, alternatively be used.

The drive means may engage a track formed on the rotary frame. If so, the track preferably includes a rack which is engaged by teeth of a sprocket forming a part of the drive means.

To improve the stability of the apparatus, two sprockets are preferably provided each engaging a separate rack on either side of the rotary frame.

Preferably the coating apparatus is formed in two halves, the two halves being pivotally connected to enable the apparatus to be opened to receive or release an article.

Preferably the two halves of the apparatus are held closed, during coating, by means of a catch. The catch may comprise a locking cylinder for engaging and disengaging a hook lock. Any other suitable locking device may, of course, alternatively be used.

A limit switch is preferably provided to prevent the two halves of the apparatus from being opened except when the rotary frame is at top dead center.

The support frame is preferably manufactured primarily from non-metallic material. The rotary frame is preferably manufactured primarily from aluminium. More preferably, the rotary frame is coated with teflon (registered Trade Mark) or some other low friction material.

The chambers and/or ducts of the apparatus are also preferably coated with teflon of some other low friction material to assist the flow of coating material through the apparatus. This is particularly important if the coating material is a powder. Other coating materials can, of

course, alternatively be used, such as fluids or even gases.

If the article to be coated is an oil or gas pipeline, the powder may be fusion bonded epoxy. The apparatus could, however, be used to deliver any other appropriate powder or fluid.

A specific embodiment of the present invention is now described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a sectional end view of a coating apparatus according to the present invention; and

Figure 2 is a partial cross-sectional side view along the line A-A of the coating apparatus of Figure 1.

With reference to the drawings, a coating apparatus 1 comprises a support frame 3, a rotary frame 5 and at least one powder delivery/spray head 7, of which there are two shown in Figure 1. The support frame 3 includes two open space frames 9 joined together by location bars 11 extending parallel to the axis of the openings 12 in the space frames 9. The openings 12 in the space frames 9 are aligned so that a pipe or other article can pass through the coating apparatus 1.

Mounted on the location bars 11 is an annular body 13 defining an opening for receiving the rotary frame 5. The annular body 13 has a number of enlarged supply ports 15 defined therein which communicate with external pipes 17 supplying powdered F.B.E. to the coating apparatus. The number of supply ports 15 and supply pipes 17 depends upon the size of the apparatus, which can be designed to accommodate pipes having diameters from 3 inches (7.6 centimetres) to 64 inches (163 centimetres) or more. Although a plurality of separate supply ports 15 are preferably provided in the preferred coating apparatus, a single annular supply port or chamber could be incorporated in the body portion 13 of the support frame 3, if desired.

The space frames 9 carry a plurality of rollers 19, extending inwardly from the space frames 9, which engage bearing surfaces 21 of the rotary frame 5. As a result, the rotary frame 5 is supported on either side by the rollers 19

and is free to rotate about the central axis of the coating apparatus 1 as the bearing surfaces 21 pass over the rollers 19. More particularly, the bearing surfaces 21 are grooves formed in the surface of the rotary frame 5, thereby securing the rotary frame 5 in position within the support frame 3 (as shown in Figure 2).

The rotary frame 5 is formed in two parts which, when assembled, are joined by means of screws 23 or any other suitable fixing means. As a result, assembly of the apparatus 1 is simplified.

The rotary frame 5 includes a plurality of radial ducts 25 opposing the supply ports 15 of the support frame 3. As a result, powdered F.B.E. supplied to the coating apparatus 1 accumulates in the chambers formed by the supply ports 15 and the radial ducts 25 before reaching the spray heads 7 for delivery to the surface of a pipeline extending through the coating apparatus 1. Annular seals 27 extend around the body portion 13 of the support frame 3 to prevent the unwanted escape of powdered F.B.E. as the rotary frame 5 rotates relative to the support frame 3. These annular seals 27 are held in position by means of seal rings 29, as shown in Figure 2 of the drawings. Mounting of the seals 27 is one of the assembly procedures which is facilitated as a result of the rotary frame 5 being formed in two parts. This is because the annular seals 27 can be inserted in the body portion 13 of the support frame 3 before the two halves of the rotary frame 5 are placed in position and screwed together.

On either side of the body portion 13, the rotary frame 5 includes a rack 31 for engagement by a sprocket wheel 33 off a drive means 35 mounted on the support frame 3. Thus, when the drive means 35 is triggered, the sprocket wheels 33 are rotated, thereby urging the rotary frame 5 to rotate about the axis of the coating apparatus 1 relative to the support frame 3. Hence, if the rotary frame 5 is rotated whilst powdered FBE is applied to the apparatus 1, the spray heads 7 will discharge powdered FBE around the complete circumference of an article, such as a pipeline, passing

through the coating apparatus 1. In this way, a more convenient and efficient coating process is provided.

Further, if the support frame 3 is arranged to be moveable along a pipeline, which is a relatively simple matter, a complete pipeline can be coated simply by moving the support frame 3 slowly whilst the rotary frame 5 rotates relative thereto. Furthermore, if a heating unit moves in front of the coating apparatus 1, a complete sintering of FBE can be readily achieved onto the surface of a pipeline.

To enable the coating apparatus 1 to be mounted on a pipeline or the like, the complete apparatus 1 is formed in two halves pivotally connected about pivot axis 37. The coating apparatus 1 can therefore be opened and closed to accept or release a pipeline or other article to be coated. When the apparatus 1 is closed, a cylinder 39 drives a hook catch 41 to lock the assembly 1 in position. A limit switch 43 is also provided to prevent the assembly 1 from being opened except when the rotary frame 5 is positioned at top dead center relative to the support frame 3.

Although not shown in the drawings, the apparatus 1 may be supplied with an on-board microprocessor which can be interfaced with a control system supplied with a parent machine. As a result, it is possible for the coating apparatus 1 to be controlled during a coating operation from a distance.

Although a specific embodiment of the present invention has been described, it should be appreciated that the coating apparatus 1 can be used as an integral part of a larger system, which is self-propelled along a pre-blasted pipe. The complete system may heat and coat progressively any length of pipe, as desired. Furthermore, a pipe suspended between mandrels may be coated using the apparatus 1 in a factory, for example. In such an environment, articles having bends or other shapes may similarly be coated using the apparatus.

Since the coating apparatus 1 is able to be opened and closed about an article, it is particularly suitable for coating flanged spools, for example. Furthermore, the

apparatus may be used for coating the cutback area of each end of a pipe after a weld joint between two pipe sections has been completed. Any number of other applications can, of course, also be envisaged.

With reference to the specific embodiment described above, the support frame 3 is ideally manufactured from non-metallic material and may be coated with a non-stick surface to ease the motion of the rotary frame 5 relative to the support frame 3. Likewise, rotary frame 5, which is preferably manufactured from aluminium, is also coated with a non-stick surface, possibly teflon (registered Trade Mark). Other materials can, of course, be used for the various components of the apparatus, depending upon the circumstances.

Finally, as mentioned above, the supply ports 15 and ducts 25 are preferably coated with a non-stick material, such as teflon. This is particulary important if the coating material is a powder, such as fusion bonded epoxy. Other coating materials can also be applied using an apparatus according to the present invention, such as fluids or gases, if it is appropriate to do so.

It will of course be understood that the present invention has been described above purely by way of example, and that modifications of detail can be made within the scope of the invention.

CLAIMS

1. A coating apparatus comprising a support frame, a rotary frame carried by the support frame, drive means carried by the support frame for rotating the rotary frame and at least one delivery head mounted on the rotary frame for applying a coating to an article, wherein the support frame includes at least one supply port for receiving a supply of coating material and the rotary frame includes at least one duct communicating between the supply port and the delivery head such that, as the rotary frame is rotated by the drive means, a supply of coating material is provided to the delivery head to enable a coating to be applied to an article.

2. An apparatus as claimed in claim 1, wherein the article is a pipe and the support frame is movable in the axial direction of the pipe.

3. An apparatus as claimed in claim 1 or claim 2, wherein the or each delivery head, during use, delivers coating material towards the center of the apparatus.

4. An apparatus as claimed in any preceding claim, wherein the rotary frame is carried by the support frame via a plurality of rollers acting between the rotary frame and the support frame.

5. An apparatus as claimed in claim 4, wherein the rollers are mounted on a space frame of the support frame and engage a bearing surface formed on the rotary frame.

6. An apparatus as claimed in any preceding claim, wherein the support frame includes two space frames joined by a plurality of location bars.

7. An apparatus as claimed in any preceding claim, wherein seals act between the support frame and the rotary frame to

prevent unwanted escape of coating material as the rotary frame rotates.

8. An apparatus as claimed in claim 7, wherein the seals are held in position in the support frame by means of seal rings attached to the support frame.

9. An apparatus as claimed in any preceding claim, wherein the rotary frame is formed in two halves to facilitate assembly of the coating apparatus.

10. An apparatus as claimed in any preceding claim, wherein the drive means engage a track formed on the rotary frame.

11. An apparatus as claimed in claim 10, wherein the track includes a rack which is engaged by teeth of a sprocket forming a part of the drive means.

12. An apparatus as claimed in any preceding claim, wherein the apparatus is formed in two halves, the two halves being pivotally connected to enable the apparatus to be opened to receive or release an article.

13. An apparatus as claimed in claim 12, wherein the two halves of the apparatus are held closed, during coating, by means of a catch.

14. An apparatus as claimed in claim 13, wherein the catch comprises a locking cylinder for engaging and disengaging a hook lock.

15. An apparatus as claimed in any one of claims 12-14, wherein a limit switch is provided to prevent the two halves of the apparatus from being opened except when the rotary frame is at top dead center.

16. An apparatus as claimed in any preceding claim, wherein a chamber is formed by a supply port and a duct for

accumulating material prior to coating.

17. An apparatus as claimed in any preceding claim, wherein the support frame is manufactured primarily from non-metallic material.

18. An apparatus as claimed in any preceding claim, wherein the rotary frame is manufactured primarily from aluminium.

19. An apparatus as claimed in claim 17, wherein the rotary frame is coated with low-friction material, such as teflon (registered Trade Mark).

20. An apparatus as claimed in any preceding claim, wherein the supply ports and ducts are coated with low-friction material to assist the flow of coating material.

21. An apparatus as claimed in any preceding claim, wherein the coating material is a powder.

22. An apparatus as claimed in claim 21, wherein the powder is fusion bonded epoxy.

23. A coating apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.